

Huygens Crater: Insights into Noachian Volcanism, Stratigraphy, and Aqueous Processes

Workshop Abstract #1032

S.E. Ackiss¹, J.J. Wray², K.D. Seelos³, and P.B. Niles⁴

¹Purdue University

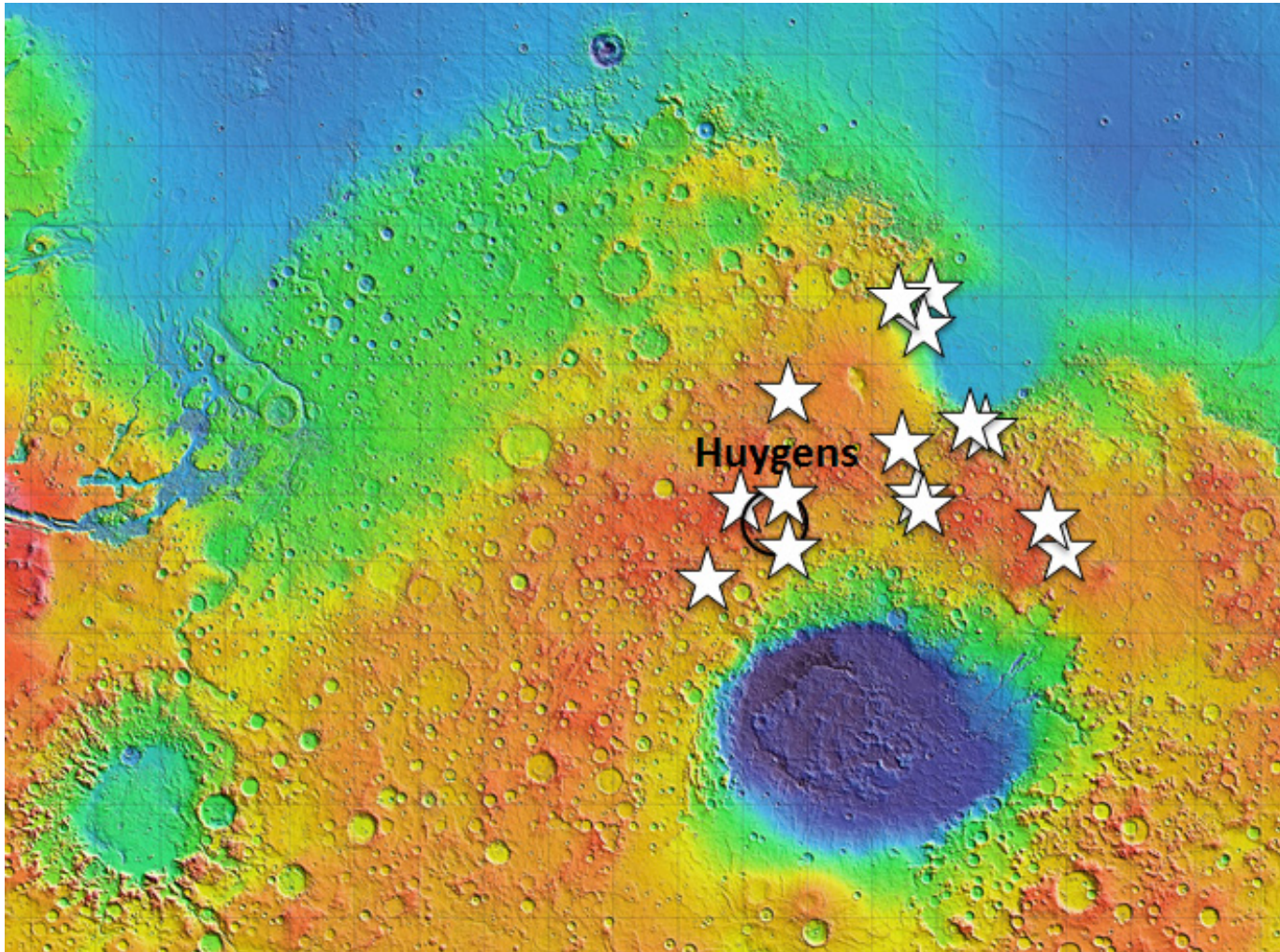
²Georgia Institute of Technology

³Johns Hopkins University Applied Physics Lab

⁴NASA Johnson Space Center

Regional occurrences of carbonates

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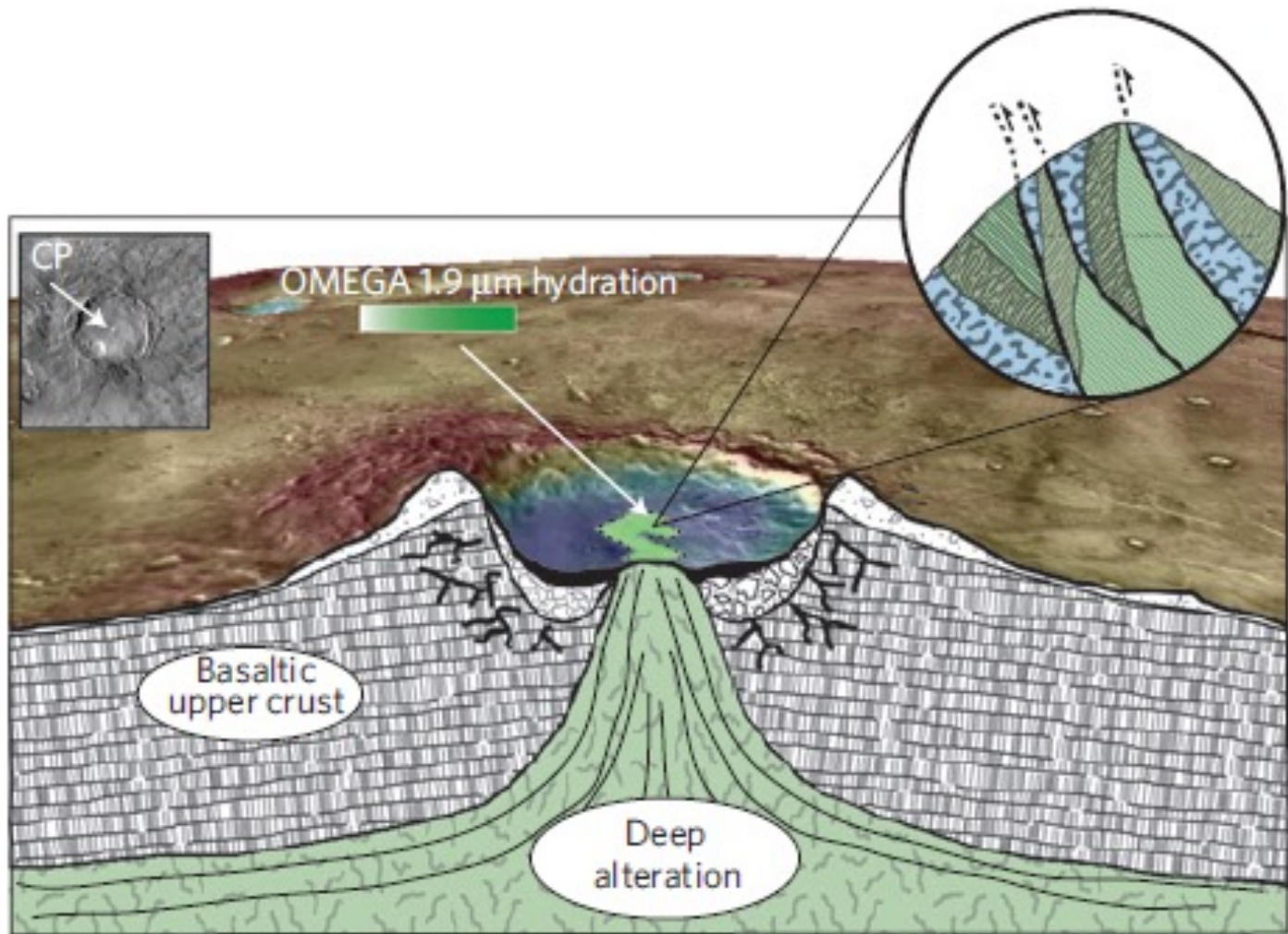


*Ehlmann et al., 2008; Niles et al., 2013; Wray et al., 2011;
Michalski and Niles, 2010; Carrozzo et al., 2013*

Huygens Crater

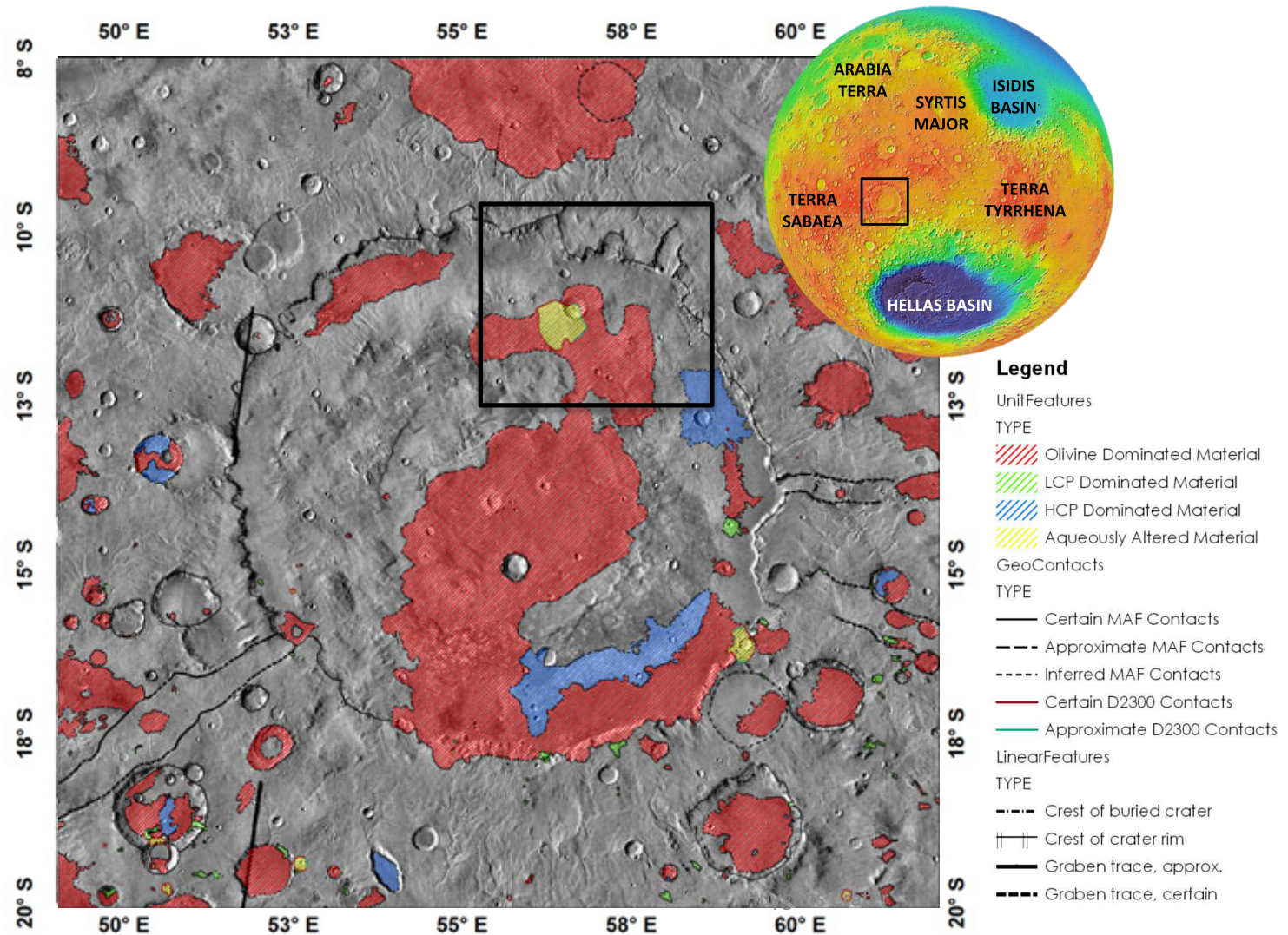
Buried Carbonate Layers

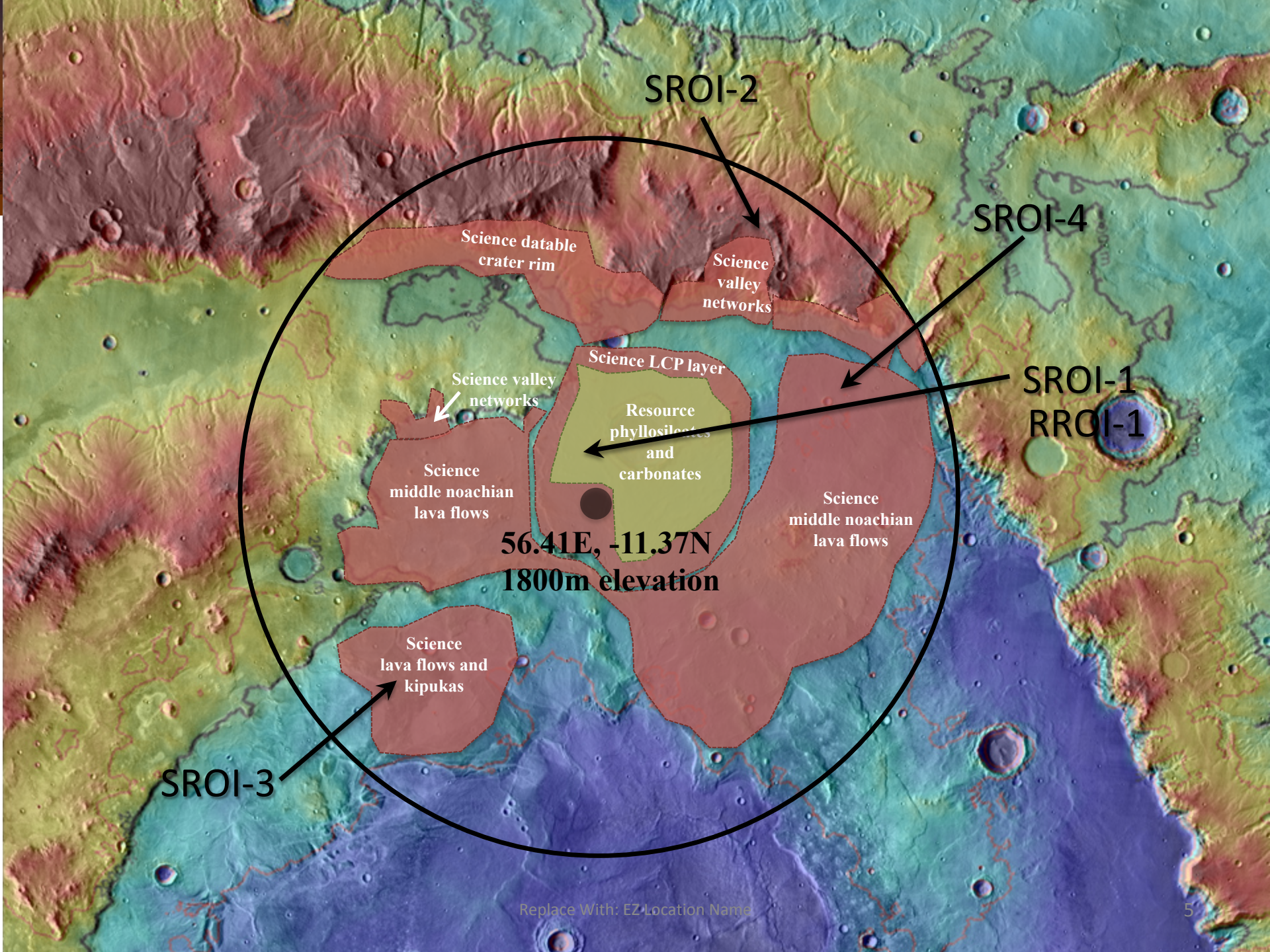
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Mineralogy of Huygens crater

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SROI-2

SROI-4

SROI-1
RROI-1

SROI-3

Science datable
crater rim

Science
valley
networks

Science valley
networks

Science LCP layer

Resource
phyllosilicates
and
carbonates

Science
middle noachian
lava flows

Science
middle noachian
lava flows

Science
lava flows and
kipukas

56.41E, -11.37N
1800m elevation

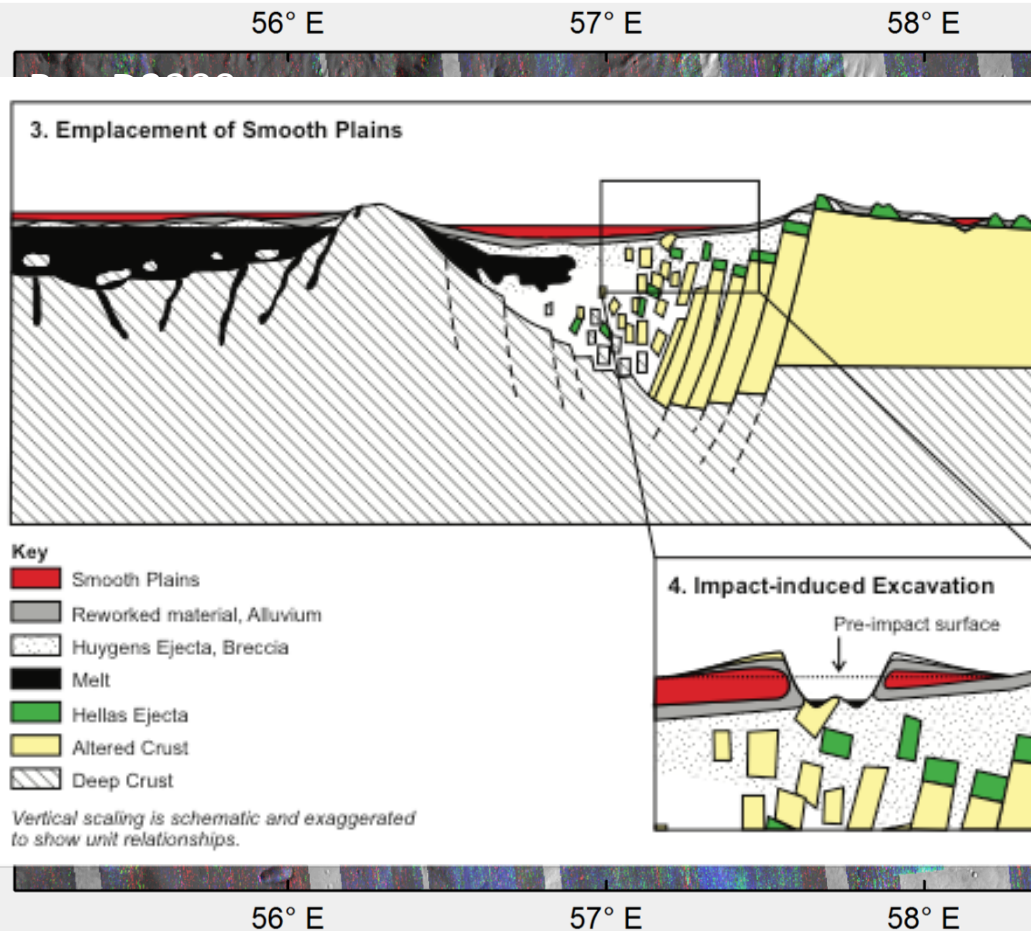
Replace With: EZ Location Name

[in order of priority: addressing threshold first, then qualifying]

SCIENCE ROIs

Pyroxene layer under phyllosilicate ejecta

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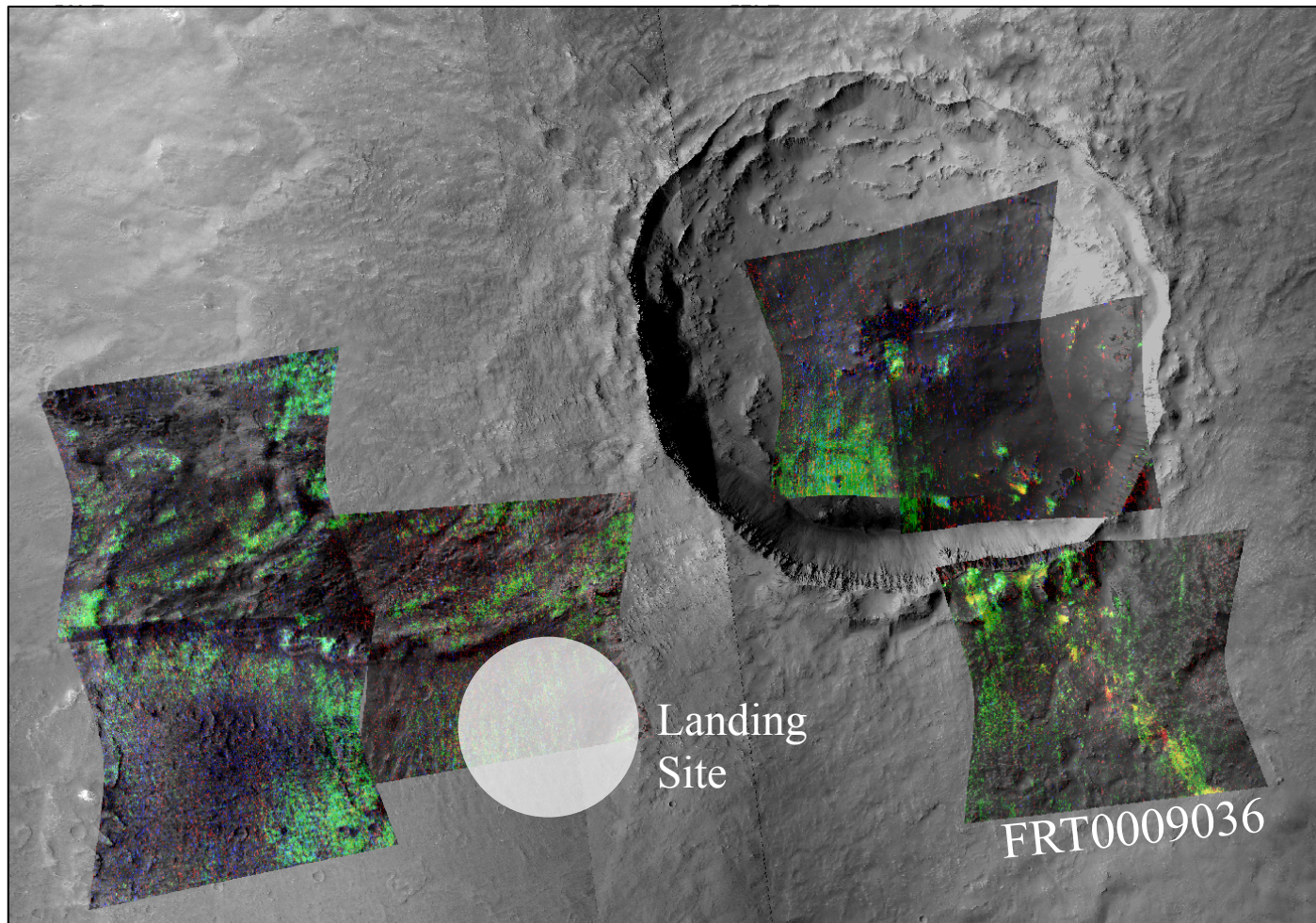
- 57.04E, -11.52N
- 1.77 km elevation
- Mafic pyroxene-rich layer under the phyllosilicates could be showing a sampling of Hellas ejecta or a plains unit

CRISM mapping data summary
parameters over THEMIS daytime IR

Huygens Crater

Phyllosilicate and Carbonate SROI-1

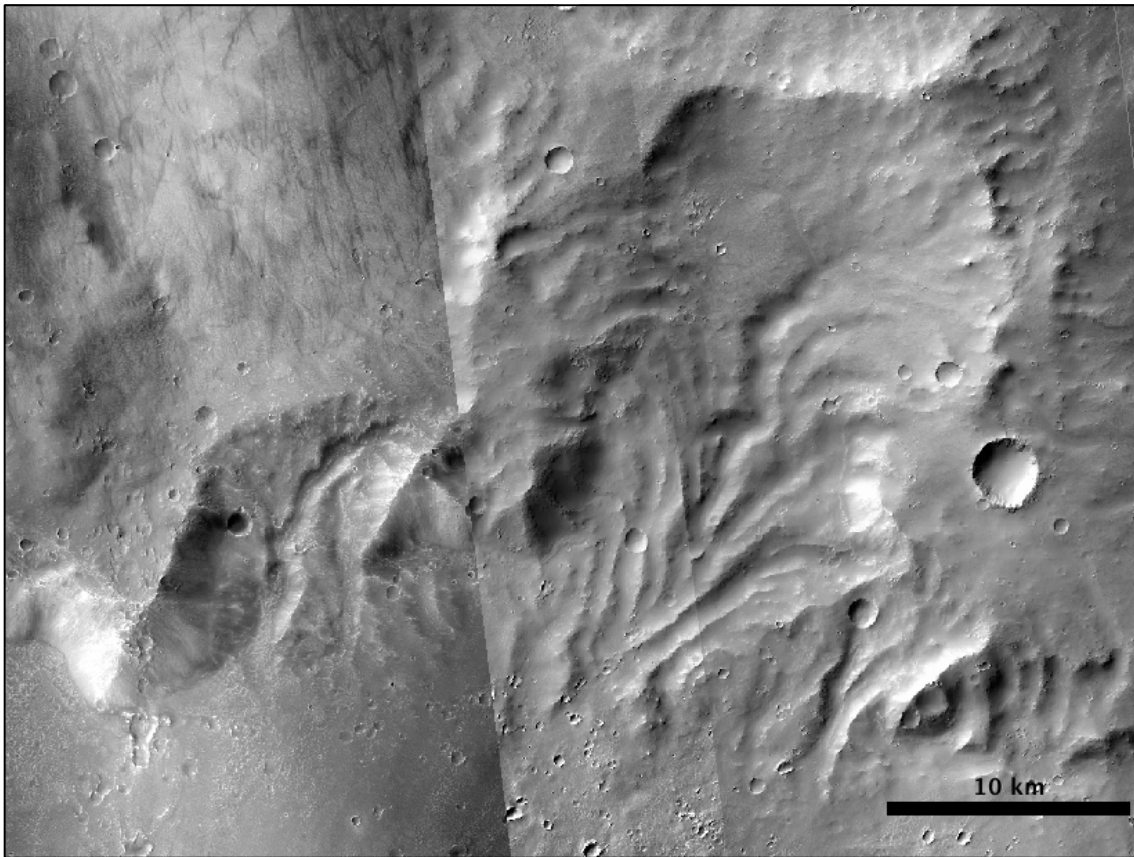
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CRISM PFM
parameter map
showing
R: BD2355,
G: D2300,
B: BD2290. The
scene contains a
wide variety of
resources
including
carbonates,
kaolinite,
smectites, and
chlorite.

Datable crater rim and valley networks SROI-2

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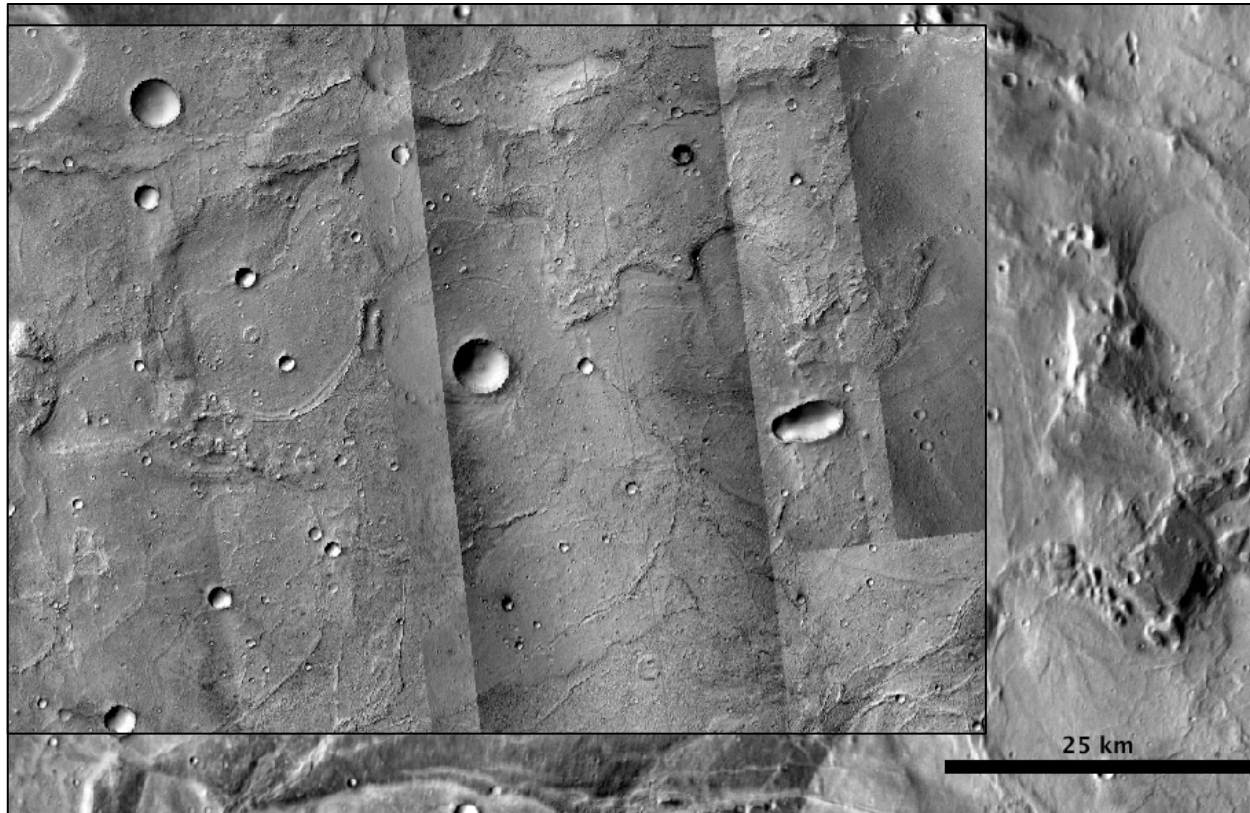


- All along the crater rim are valley networks
- These networks have no associated spectral signature and very little HiRISE coverage

57.1E, -10.34N
2000m; on rim
CTX data

Volcanic Melt Islands SROI-3

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55.71E, -12.31N

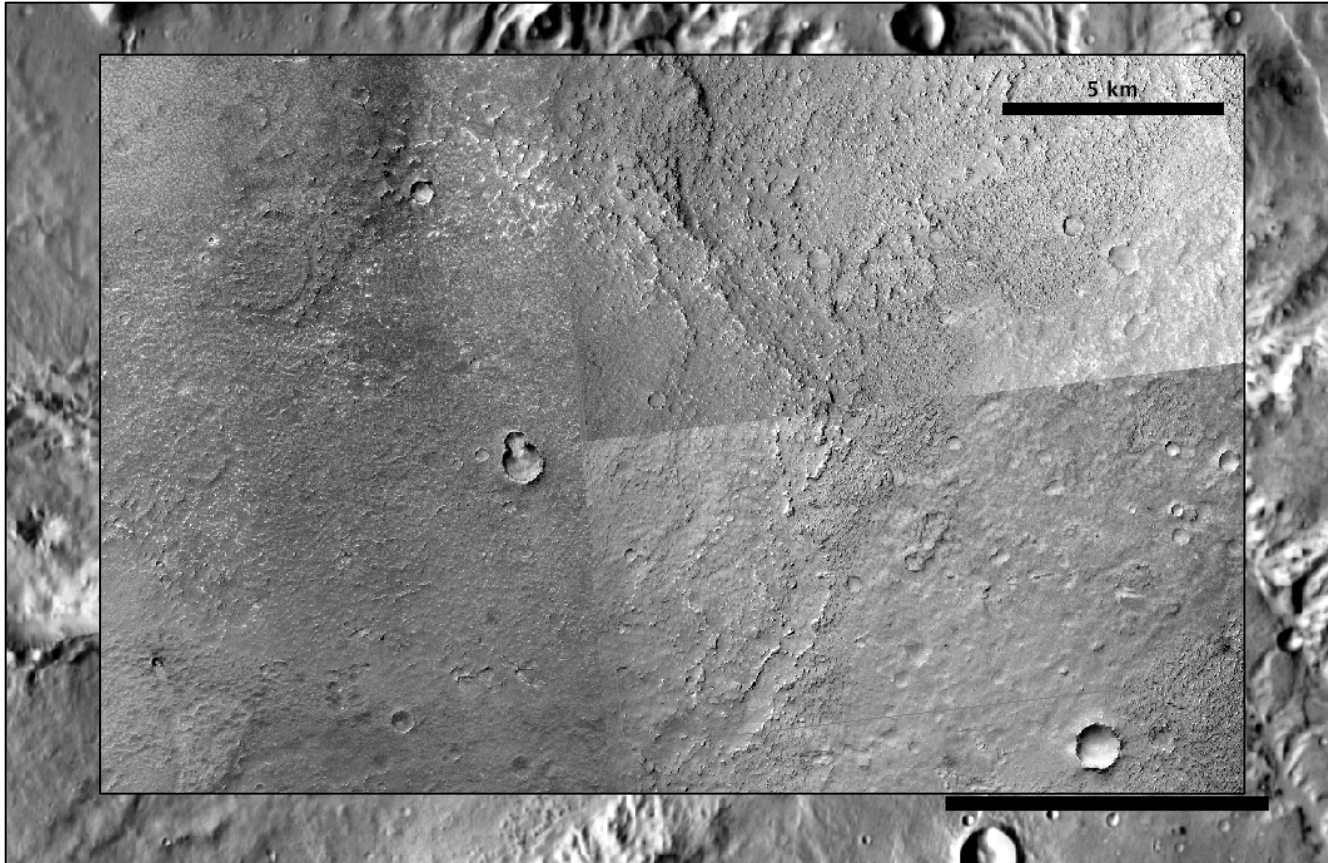
1.71 km elevation

THEMIS Day IR and CTX data

- <Kim and I are still unsure about what these are. We've thought they might be impact melt but later scratched that because of the timing.>

Olivine-rich plains units SROI-4

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- High thermal inertia with little eolian materials
- Spectrally dominated by olivine but often mixed/gradational with high calcium pyroxene.

57.65E, -11N

1.53 km elevation

THEMIS Day IR and CTX data

Huygens Crater

[in order of priority: addressing threshold first, then qualifying]

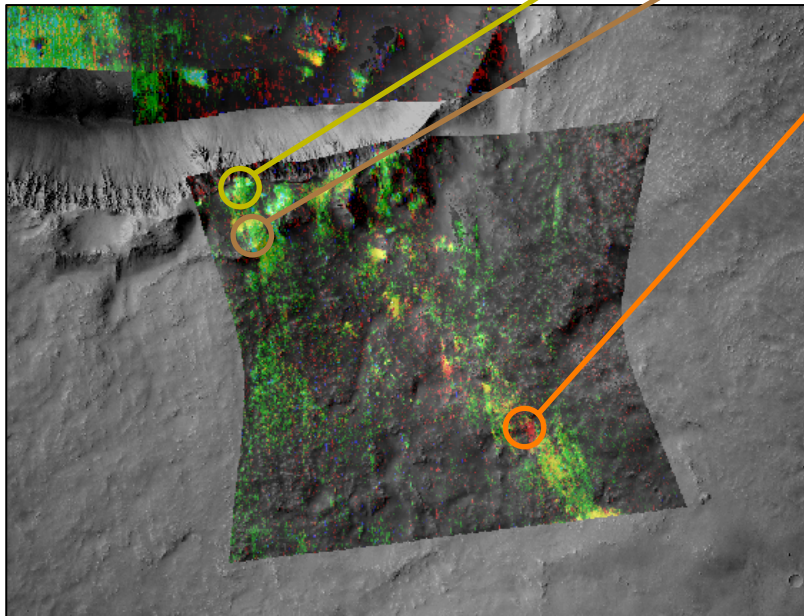
RESOURCE ROIs

Spectral diversity surrounding this unnamed crater RROI-1

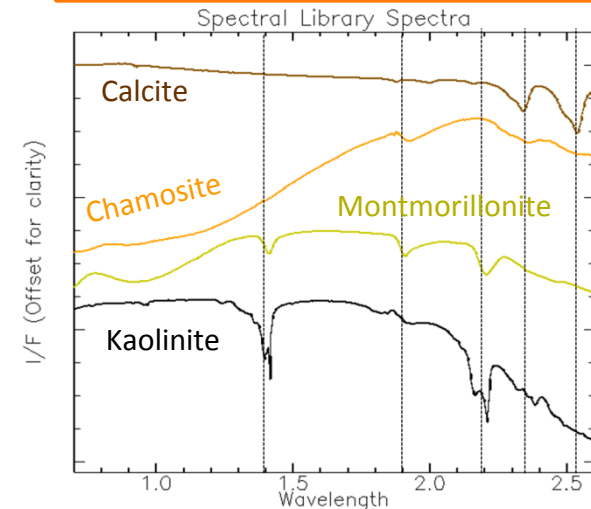
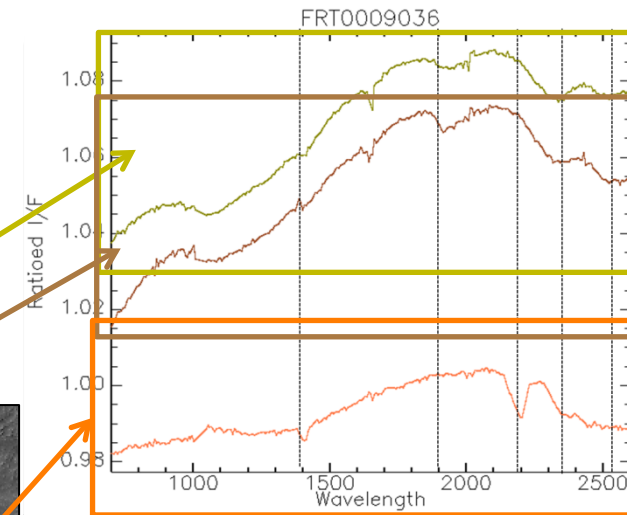
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- Land on resource minerals (carbonate and /or chlorite)
- More diversity roughly 15km from the landing site.
- Crater rim lies at 2km elevation while the ejecta is 1.84km elevation

FRT0009036 (R: BD2355, G: D2300, B: BD2290) over CTX image P12_005724_1678_xi_12S303W.



Huygens Crater



RUBRICS

Science ROI(s) Rubric

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Site Factors					SROI1	SROI2	SROI3	SROI4	RROI1	EZ SUM	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	●	●	●	●	●		
				Potential for present habitability/refugia							
		Qualifying	Potential for organic matter, w/ surface exposure			●	●	●	●	●	
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases			●	●	●	●	●	
		Qualifying	Meteorological diversity in space and time			●	●	●	●	●	
			High likelihood of surface-atmosphere exchange			●	●	●	●	●	
			Amazonian subsurface or high-latitude ice or sediment								
			High likelihood of active trace gas sources			●	●	●	●	●	
	Geoscience	Threshold	Range of martian geologic time; datable surfaces			●	●	●	●	●	
			Evidence of aqueous processes			●	●	●	●	●	
			Potential for interpreting relative ages			●	●	●	●	●	
		Qualifying	Igneous Rocks tied to 1+ provinces or different times			●	●	●	●	●	
			Near-surface ice, glacial or permafrost								
			Noachian or pre-Noachian bedrock units			●	●	●	●	●	
			Outcrops with remnant magnetization								
Primary, secondary, and basin-forming impact deposits			●	●	●	●	●				
Structural features with regional or global context			●	●	●	●	●				
Diversity of aeolian sediments and/or landforms			●	●	●	●	●				

Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

Resource ROI(s) Rubric

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Site Factors				SROI1	SROI2	SROI3	SROI4	RROI1	EZ SUM	
ISRU and Civil Engineering Criteria	Engineering		Meets First Order Criteria (Latitude, Elevation, Thermal Inertia)		●	●	●	●	●	
	Water Resource	Threshold	AND/ OR	Potential for ice or ice/regolith mix						
				Potential for hydrated minerals	●				●	
			Quantity for substantial production	○				○		
			Potential to be minable by highly automated systems	●				●		
			Located less than 3 km from processing equipment site	●				●		
			Located no more than 3 meters below the surface	●				●		
			Accessible by automated systems	●				●		
	Qualifying		Potential for multiple sources of ice, ice/regolith mix and hydrated minerals							
			Distance to resource location can be >5 km		●				●	
			Route to resource location must be (plausibly) traversable		●				●	
	Civil Engineering	Threshold	~50 sq km region of flat and stable terrain with sparse rock distribution		●				●	
			1–10 km length scale: <10°		●				●	
			Located within 5 km of landing site location		●				●	
	Qualifying		Located in the northern hemisphere							
			Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith		●	●	●	●	●	
			Utilitarian terrain features		●	●	●	●	●	
	Food Production	Qualifying	Low latitude		●	●	●	●	●	
			No local terrain feature(s) that could shadow light collection facilities		●	●	●	●	●	
			Access to water		●				●	
			Access to dark, minimally altered basaltic sands		●	●	●	●	●	
	Metal/Silicon Resource	Threshold	Potential for metal/silicon		○	○	○	○	○	
			Potential to be minable by highly automated systems		○	○	○	○	○	
			Located less than 3 km from processing equipment site		○	○	○	○	○	
			Located no more than 3 meters below the surface		○	○	○	○	○	
			Accessible by automated systems		○	○	○	○	○	
		Qualifying	Potential for multiple sources of metals/silicon		○	○	○	○	○	
			Distance to resource location can be >5 km		○	○	○	○	○	
			Route to resource location must be (plausibly) traversable		○	○	○	○	○	

Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

Highest Priority EZ Data Needs

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- More coverage by HiRISE and CRISM
 - *Detection of altered Noachian Crust*
 - *Differentiation between Hellas Ejecta*
 - *Subsurface Geology*
- Major Subsurface Story (Radar, Lander)
 - *Buried Carbonate Units*
 - *Effects of Huygens Crater Structures*
 - *Sources of lava flows*
 - *Hydrothermal systems?*

BACKUP SLIDES